

BACTERIOLOGY OF PYODERMAS

By

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There are various reports concerning the bacteriology of Impetigo contagiosa (Cruickshank, 1941; Bigger and Hodgson 1943; Barrow 1955) and cutaneous sepsis as a group (Livingood, 1953; Forbes 1953; Lamont 1959). There has, however, been little work done to find out the bacteriology of different pyogenic dermatoses especially at different stages of the lesion. Regarding the bacteria which have been found, there are many reports of drug resistance (Hinton 1957; Chatterjee 1959; Ganor 1961), but the concentrations of drugs used in discs for determining sensitivity have been in strengths that bear a relation to levels attained in blood and body fluids after administration of therapeutic doses.

This communication describes the bacterial flora of different pyogenic dermatoses at various stages of the lesions and testing their sensitivity to different drugs in proportional strengths in which these are available in common topical preparations.

MATERIAL AND METHODS

Material. One hundred cases in all were studied. Ninety six were taken from the Dermatological out-patient department of the A. I. I. M. S. with only four cases from the wards. Only those cases who had not already taken any antibiotic or sulphonamide before reporting were taken. The cases as classified into different clinical types—both by age and sex—are given in Table I.

Methods of Isolation of Bacteria. Lesions were swabbed with alcohol and from the pus subsequently obtained a smear was made for bacterial study after Gram's staining. Simultaneously the material was inoculated into glucose broth and thioglycollate broth. In cases of intact pustular lesions, the pustule was ruptured with a sterile needle and material taken with a platinum loop. In crusted lesions, crusts were partly lifted and material taken from underneath.

After incubating glucose broth for 24 hours and thioglycollate broth for 48 hours at 37°C smears were made from these and examined after Gram's staining. The material from these was then inoculated on blood agar plates under aerobic and anaerobic conditions. For plate anaerobiosis, use was made of pyrogallic acid and anhydrous sodium carbonate (Carlquist 1959, Barua 1961). The

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organisms were then identified. Slide coagulase test was done in cases staphylococci were obtained. Beta-haemolytic streptococci were not further typed out.

TABLE I

Clinical Diagnosis	Number of cases (age and sex-wise)										Total
	0-10		11-20		21-30		31-40		Above 41		
	M	F	M	F	M	F	M	F	M	F	
Impetigo	7	9	-	2	-	3	-	-	-	-	21
Ecthyma	-	-	-	2	-	-	-	-	-	-	2
Sup. Folliculitis	-	2	2	1	5	1	-	-	1	1	13
Deep Folliculitis	-	-	2	-	3	-	1	-	1	-	7
Furunculosis	2	5	6	-	2	2	-	1	-	1	19
Carbuncle	-	-	-	-	-	-	-	-	2	-	2
Intertrigo	-	-	-	-	-	1	-	-	-	-	1
Paronychia	-	-	-	1	-	-	-	-	-	-	1
Multiple abscesses	-	1	-	-	-	-	-	-	-	-	1
Dermatitis repens	-	-	-	-	-	-	1	-	-	-	1
Infective eczemas	10	2	-	1	2	-	1	-	-	-	16
Secondary Pyogenic Dermatoses	6	3	3	1	1	-	1	-	1	-	16
Total	25	22	13	8	13	7	4	1	5	2	100

Method of Drug Sensitivity. The sensitivity of organisms so isolated was tested by the dry disc method. The amounts of drugs used per disc and as compared with those recommended by Schaub et al and Stokes are given in Table II.

TABLE II

No.	Name of Drug	Strength in Topical preparation	Amount of drug per disc Recommended by		
			Present work	Schaub et al	Stokes
1.	Penicillin	1000 U/G	40 U	2 U	10 U
2.	Streptomycin	1%	40 mcg.	10 mcg.	200 mcg.
3.	Erythromycin	0.5%	20 mcg.	2 mcg.	2 mcg.
4.	Chloramphenicol	1%	40 mcg.	5 mcg.	100 mcg.
5.	Tetracycline	3%	120 mcg.	5 mcg.	—
6.	Oxytetracycline	3%	120 mcg.	5 mcg.	100 mcg.
7.	Chlortetracycline	3%	120 mcg.	5 mcg.	100 mcg.
8.	Neomycin	0.5	20 mcg.	30 mcg.	—
9.	Bacitracin	500 U/gm	20 U	2 U	—
10.	Sulphadiazine	—	400 mcg.	1000 mcg.	400 mcg.

In each case 3-5 well isolated colonies of a single bacterial type were inoculated to a tube of peptone water and incubated at 37°C for 3-4 hours. It was then poured in a nutrient or blood agar plate depending on the organism isolated and then decanted and plate dried in incubator. The discs were then embedded on plate, five in each plate. After overnight incubation, the clear zone around each disc was measured in millimetres.

RESULTS

Bacteriological studies of these cases revealed 110 strains as given in Table III.

TABLE III

Total number of Staphylococcus aureus (coagulase + ive) strains ...	68
Total number of Streptococcus Beta-Haemolyticus strains ...	39
Total number of Escherichia Coli strains ...	5
Total number of proteus vulgaris strains ...	1
	113

The causative organisms were present either alone or in combinations. Of the lone types, the staphylococcus aureus (coagulase + ive) was found in majority and next common was Beta-haemolyticus streptococcus. Combinations were found between different bacteria and the details of which are given in Table IV below.

TABLE IV

Staphylococcus aureus (coagulase + ive) alone ...	57
Streptococcus B-Haemolyticus alone ...	28
Escherichia coli alone ...	2
Staphylococcus aureus (coagulase + ive) + Streptococcus B. Haemolyticus ...	9
Staphylococcus aureus (coagulase + ive) + Escherichia coli ...	2
Streptococcus B-Haemolyticus + E. Coli ...	1
Streptococcus B-Haemolyticus + Proteus vulgaris ...	5
	100

RELATION TO CLINICAL CONDITION

Impetigo Contagiosa. Of the twentyone cases studied under this entity, staphylococcus aureus (coagulase + ive)* alone was isolated in twelve. The duration of lesions was between 4 to 8 days in five cases and 10 to 20 days in four cases while 45 to 75 days in other 3 cases.

Streptococcus B-Haemolyticus* alone was present in six cases and duration of lesion was from 4 to 10 days.

* Only word staphylococcus or streptococcus will be used for these in rest of description.

Combined Staphylococcus were found in three cases. The duration of lesions was 7 days in two cases and 60 days in one case.

No correlation could be made between the type of bacteria obtained, the clinical picture of Impetigo and the duration of the lesions.

Ecthyma. Only two cases were studied. In one case streptococcus was found alone and in other cases in combination with staphylococcus.

Superficial Folliculitis. In the study of thirteen cases of superficial folliculitis staphylococcus was found alone in all cases but one, when it was associated with *E. coli* was isolated.

Sycosis Barbae. Seven cases in all were studied. In six cases staphylococcus alone and in one, in combination with *E. coli*, was isolated.

Furunculosis. Culture of pus from boils of nineteen cases yielded pure staphylococcus in eighteen cases and pure *E. Coli* growth in one case. The site of lesion in the latter was leg.

Carbuncle. Only two cases were encountered one of which occurred in a case of exfoliative dermatitis and culture report in both was staphylococcus.

Intertrigo. In this series a single case of intertrigo of interdigital spaces of feet gave a mixture of staphylococcus and streptococcus on culture.

Paronychia. One case of acute paronychia in female gave streptococcus and proteus vulgaris.

Multiple Abscesses. A small child with multiple abscesses showed staphylococcus and streptococcus combination.

Dermatitis Repens. One case included in the series gave staphylococcus alone.

INFECTIVE ECZEMA

Sixteen cases in all were studied. In eleven cases, lesions were present on scalp, in two cases on ear-lobules and surrounding skin, in three cases on extremities.

The lesions on ear-lobules, extremities and five cases of infective eczema of scalp yielded streptococcus alone. Two cases of infective eczema scalp gave staphylococcus alone and two cases in combination with streptococcus. In one case only *E. coli* was isolated and in one case in combination with Streptococcus.

SECONDARY PYODERMAS

These included infected scabies (9), infected miliaria (1), infected wounds (2), infected pemphigus lesions (2), infected eczema (1), infected fungus infection (1). Pure culture was obtained, in eleven cases, of streptococcus and in four cases, of staphylococcus. In one case there was a mixture of two.

Susceptibility to antibiotics and sulphadiazine. The strains with which drugs produced a zone of inhibition of less than 15 mms. in diameter were considered

resistant and those with a zone of inhibition between 15 to 24 mms. were considered sensitive and those with a zone of more than 25 mms. were considered highly sensitive.

Staphylococci Sixty-eight strains isolated were subjected to sensitivity tests and the results were as given in Table V.

TABLE V

Sensitivity pattern of Staphylococci—68 strains

Drug	Zones of Inhibition					
	0—14 mm.		15—24 mm		25 mm and above	
	Total Strains	%	Total strains	%	Total strains	Total
Sulphadiazine	46	67.7	22	32.3	0	0
Penicillin	33	48.5	29	42.6	6	8.9
Streptomycin	34	50	32	47.1	2	2.9
Erythromycin	1	1.5	45	66.2	22	32.3
Chloramphenicol	1	1.5	45	66.2	22	32.3
Tetracycline	1	1.5	46	67.6	21	30.9
Oxytetracycline	0	0	49	72.1	19	27.9
Chlortetracycline	1	1.5	48	70.6	19	27.9
Neomycin 44 strains	0	0	40	90.9	4	9.1
Bacitracin 34 strains	1	2.9	33	27.1	0	0

Str ptococci. 39 strains were isolated and subjected to sensitivity tests and their results are given in Table VI.

TABLE VI

Sensitivity pattern of Streptococci—39 strains

Drug	Zones of Inhibition					
	0—14 mm		15—24 mm		25 mm and above	
	Total Strains	%	Total Strains	%	Total Strains	%
Sulphadiazine	20	51.3	18	46.2	1	2.5
Penicillin	10	25.6	20	51.3	9	23.1
Streptomycin	7	17.9	29	74.4	3	7.7
Erythromycin	1	2.5	35	89.8	3	7.7
Chloramphenicol	0	0	28	71.8	11	28.2
Tetracycline	0	0	26	66.7	13	33.3
Oxytetracycline	2	5.1	26	66.7	11	28.2
Chlortetracycline	3	7.7	24	61.5	12	30.8
Neomocin 29 strains	1	3.4	28	96.6	0	0
Bacitracin 25 strains	1	4.0	24	96.0	0	0

Gram Negative Bacilli. Out of five E. Coli strains, one was resistant to sulphadiazine, two to streptomycin, three to Penicillin, maximum sensitivity was towards chloramphenicol. The only strain of proteus vulgaris isolated was resistant to sulphadiazine and penicillin.

DISCUSSION

Bacterial Flora. Those lesions in which infection is primarily in relation to hair follicles (superficial folliculitis, sycosis, furunculosis, carbuncle) are mostly caused by staphylococci. Kile (1952) found in all seventeen cases of folliculitis and furuncles he studied, pure staphylococcal growth. Pilsbury (1957) described these conditions to be of staphylococcal origin, but under unusual circumstances other organisms such as coliform bacillus may be causative. We had out of 41 cases, two in which pure E. coli and in one in combination with staphylococcus was obtained but there was nothing unusual about these cases.

Impetigo contagiosa was first considered to be of streptococcal origin by Crocker in 1881. Barber and Griffon (1897) recovered staphylococci from lesions but later admitted that there were technical errors. After that there had been eras in which one or other or both had been considered causative organisms. Cruickshank (1941) found staphylococcus alone in 34.8% of cases. Bigger and Hodson (1943); Parkar (1945 and 1953); Flood (1953) found staphylococcus alone in 50 to 70% of cases; Kile (1952); Church (1954) and Barrow (1955) found staphylococcus alone in 70 to 81% of cases. We found staphylococcus alone in 57% of cases. The next common was streptococcus alone 28.5% in our series as compared with mixture of staphylococcus and streptococcus in others' reports.

Sheehan and Fergusson (1943) considered that streptococcus occurred less commonly in cases in which fresh blisters are examined than those in which pus from under the crust. So they considered streptococci to be secondary invaders. Out of our 21 cases, in 9 cases fluid from fresh blisters was examined. Fresh blister fluid in 5 cases yielded pure staphylococcal culture, in two pure streptococcal and in two a mixture of both.

Ecthyma being a deeper variant of Impetigo contagiosa is caused by similar organisms.

Other pyogenic dermatoses like infective eczemas and secondary pyodermas may be caused by either streptococcus or staphylococcus. Kile (1952) found staphylococcus in 31 out of 34 cases of infective eczema, but in our series 62.5% yielded streptococcus alone. In 12.5% staphylococcus was the only organism and in 12.5% both of these and in 6.9% E. Coli alone and in 6.2% with streptococcus.

The conclusion that can be derived is that pyogenic lesions not particularly involving hair follicles can be caused by either staphylococcus and or streptococcus and clinical picture does not differ in any way for respective dermatoses, though it may be said that staphylococcus predominates in impetigo contagiosa and streptococcus in infective eczemas and secondary pyogenic dermatoses.

SENSITIVITY

After penicillin was discovered and its therapeutic role got established, hope was raised that treatment of diseases caused by bacteria will become easy, and this expectation was further raised because of the wide range of activity with newer broad spectrum antibiotics coming into therapeutic field, so much so that the need of having a sensitivity test done was minimised. The situation was again reviewed because every new drug that came in had its merits and demerits and there were resistant strains coming up which necessitated the urge to be familiar with the drugs in vogue and their use in particular conditions.

It may be stressed here that there is no practical utility to compare the results of different workers with one another in this connection because the method and again the strength used by each worker are different. Expert Committee on antibiotics W. H. O. (1961) considered the problem of recommending standard discs to be used internationally with a certain specified amount of antibiotics but found it difficult to recommend precise amount for each antibiotic.

SULPHADIAZINE

Sulphonamides are getting out of use these days in dermatologic practice, because of the risk of the sensitization when applied locally and also because of emergence of resistant strains. Finland (1955) writes that sulphonamides had long since lost their effectiveness against staphylococcus infection in hospitals. We found 2/3rd of staphylococci to be resistant and over 1/2 of streptococci to be resistant. With the additional disadvantage of sensitization, we disfavoured its use topically.

PENICILLIN

Incidence of resistant staphylococci as encountered in our studies is 48.5% using 40 units per disc as compared with 47% by Sayed (1959) using the same technique with 10 units per disc. High incidence of resistance (74%) was obtained by Parker (1955) by using wet disc method by discs soaked in solution containing 75 units per cc.

Streptococci were relatively less resistant (25.6%). 4 out of 5 strains of *E. coli* and the only strain of *Proteus Vulgaris* were resistant.

STREPTOMYCIN

This antibiotic again is not used for surface application in cases of pyoderma, though used sometimes for cases of cutaneous tuberculosis. However, we have included it, like penicillin, to compare with other antibiotics in vitro experiments for sensitivity.

Chatterjee (1959) using dilution technique with 1 mcg. of streptomycin per cc, in 30 strains of staphylococci found only 10% to be sensitive at this concentration. Ganor (1961) examined 117 strains of staphylococci and found only 34% to be resistant. We found 50.0% of staphylococci and 17.9% of streptococci to be resistant to it.

TETRACYCLINE

The resistance to tetracycline in our series of staphylococci had been 1.5%. Very high figures of 73% resistant strains have been reported by Chatterjee (1959). No strains of streptococcus was resistant in our series.

OXYTETRACYCLINE

No strain of staphylococcus was resistant in the present series. Sayed (1959) reported 2% resistant while Myeres (1956) reported 3% resistant. As high as 61% resistant staphylococci had been reported by Kirby and Ahern (1953). 5.1% of streptococci were resistant to oxytetracycline in our series.

CHLORTETRACYCLINE

5% of staphylococci have been reported to be resistant by Sayed (1959). Myeres (1958) found 3% resistant. Kirby and Ahern (1953) reported 61% resistant. Ganor (1961) found 34% resistant. We had only 1.5% staphylococci and 7.7% of streptococci resistant to chlortetracycline.

CHLORAMPHENICOL

We used 40 mcg. of this antibiotic per disc and found only 1.5% of staphylococci resistant, but all strains of streptococci were sensitive. 32.3% of staphylococci and 28.2% of streptococci were highly sensitive. Ganor (1961) reported 6% resistant strains of staphylococci.

Out of these broad spectrum antibiotics used in this study, there is nothing much to choose as each one is equally useful as the other as observed from in vitro studies.

ERYTHROMYCIN

This antibiotic is not frequently used locally or internally at our place. Ganor (1961) had reported 12% strains of staphylococci resistant to it and this is perhaps the highest figure quoted. We had only 1.5% of staphylococci and 2.5% of streptococci resistant to this antibiotic. This is probably because this antibiotic has not been widely used in India.

NEOMYCIN

We did not encounter any staphylococcus strain resistant to it, though 3.4% of streptococci were resistant. Only 9.1% of staphylococci were highly sensitive.

This antibiotic is very commonly used for topical application these days. As this is not given systemically chances of drug eruption are reduced; though some cases of cross sensitivity with streptomycin have been described (Fisher, 1959).

BACITRACIN

The diffusibility of this drug is very low (Schaub 1958) but still only 2.9% of the staphylococci and 4.0% of streptococci were found resistant to this by disc method. This again is not very much of a known sensitizing drug.

SUMMARY

One hundred cases of pyodermas were examined bacteriologically. The organisms isolated were staphylococci (68), streptococci (39), *E. Coli* (5), *Proteus vulgaris* (1). The antibiotic sensitivity pattern of these strains was determined and the results compared with some other workers.

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